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# Some Remarks on a Relational Concept of Mind

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**ABSTRACT.** This paper inquires whether psychology should be internalist or externalist, that is, whether it should consider mind as an entity in itself, or rather as a relation with the environment. Some influential theoretical arguments for internalist psychology are critically reviewed and it is concluded that there is no compelling reason for internalist psychological taxonomies. Next, some proposals for a functional or relational type of explanation in psychology are explored, and it is argued that they provide a workable alternative for internalist explanations. Finally, Gibson's ecological psychology is adduced to show the empirical feasibility of a psychology that explicitly includes environmental considerations in psychological taxonomies.

**KEY WORDS:** computational psychology, ecological psychology, functional explanation, internalism/externalism, naturalism

In a seminal paper, Fodor (1980), following James (1890/1950, p. 6), distinguishes two types of psychology: naturalistic and rational. Naturalists concentrate on organisms as embedded in their environment, and on the organism–environment interactions that constitute their behaviour; rationalists, on the other hand, ‘treat the soul as a detached existent, sufficient into itself’ (James, 1890/1950, p. 6).

Naturalism has materialism and evolutionary theory as its sources of inspiration (Churchland & Churchland, 1991; Looren de Jong, 1992), whereas rational psychology stands in the tradition of Descartes. It studies mental processes only in their internal properties, as if the environment can be completely bracketed (in Descartes's famous *Second Meditation* the world might as well have been a dream). Naturalistic psychology, on the other hand, entails what can be called a relational concept of mind: mental processes are considered as organism–environment relations (‘it takes mind in the midst of all its concrete relations’—James, 1890/1950, p. 6).

Fodor (1980) contends that (perhaps unfortunately) naturalistic psychology is impossible. Mental processes can be studied only as the internal economy of the mind, without regard to the environment. Over the years he

has elaborated a set of interconnected arguments to support that claim. These seem to entail or presuppose assumptions about the appropriate level of description of the input for perception and about what constitute legitimate types of explanation.

In this paper, these assumptions are critically evaluated, and it is contended that they constitute a too restrictive view of psychology; the possibility of a naturalist psychology as a type of functional explanation is defended and is illustrated by Gibson's ecological approach to perception.

## **Fodor's Arguments for Rational Psychology**

### *The Background: The Computational Theory of Mind*

Fodor's (1975) Computational Theory of Mind (CTM) is an attempt to provide a materialistically respectable theory of mental content, meaning and intentionality (Matthews, 1989). It proposes a separate level of analysis for mental processes, the level of representation or computation, and claims that intentional states (propositional attitudes) are identical with computational states (e.g. Matthews, 1984, 1989; Sterelny, 1991). This level is implemented in, but autonomous relative to, the 'wetware' (Fodor, 1981b), and therefore psychology, while a hard science, can proceed without regard for biology and neurophysiology.

Fodor maintains that the workings of the mind are in a literal sense computations on symbols; mental representations are symbol strings, and mental processes are manipulations on these symbols, according to formal, syntactical rules. Thus, Fodor (1975) claims that computation (in principle) accounts for the content and meaning of mental states. Intentionality can be reduced to internal, syntactically defined representations; the semantic engine of the mind is mimicked by the syntactic engine of computations. Since only the syntactic properties of these formulas can be part of cognitive science, their semantics, their reference to external objects, that is, organism–environment relations, must fall outside scientific psychology; however, it is hoped that denotational semantics might recover them by adding context to narrow content (Fodor, 1987).

*Functional role.* CTM confines the meaning of mental processes to their functional role, or, in other words, to their causal role in the internal economy of the physical symbol system. This contrasts with the use of function in biology, where function refers to an adaptive, teleological relation between organism and environment. It has been argued (e.g. Lycan, 1987; Sober, 1985) that the internal or narrow construal of function in Turing machine functionalism is a perversion of the biological concept, and that 'function should be put back into functionalism' (Sober, 1990). Psychology should include environmental adaptive considerations, rather than only

internal causal mechanisms. Hence, there is a marked contrast between narrow (or Turing machine) functionalism and teleofunctionalism. Broadly speaking, this parallels the distinction between rationalism and naturalism (Looren de Jong, 1993).

*A causal–nomological model.* CTM's construal of functional role implies that mental states play a causal role in the explanation of behaviour. Fodor (1981a, 1981b) emphasizes that mental content is what causes behaviour, and that all causally relevant distinctions can be expressed in syntactic distinctions. Causal relations between mental representations, and between mental processes and behaviour, are computations, that is, derivations of logical formulas. Since these formulas actually drive the physical machine through a succession of states, it seems that mental causation has at last gained scientific respectability; computation is a real, causal explanatory factor in behaviour. CTM shows 'how rationality is mechanically possible' (Fodor, 1987, p. 20); it is a mechanistic, albeit non-reductionist, theory of mind (Fodor, 1981a; Putnam, 1980).

Thus, CTM complies with the causal–nomological model of scientific explanation. Fodor (1991b) makes it plain that in his view common-sense psychology, cognitive science and informational semantics in the philosophy of mind are all in the business of providing genuine lawlike explanations. 'The central goal of theory construction in cognitive science is to *explicate the computational mechanisms that implement intentional laws*' (Fodor, 1991b, p. 20). Although in Fodor's (1981) view the special sciences (biology, psychology, geology) are autonomous with respect to basic sciences (physics), and although their laws are formulated at the macro-level, rather than in terms of micro-structures, they are not different from the natural sciences in their mode of explanation.

*A rationalist theory.* Fodor (1980) places himself in the Cartesian or mentalist (Putnam, 1988) tradition, where the character of mental processes is supposed to be somehow independent of their environmental causes and effects. According to one of the classics of this approach (Brentano, 1924), intentionality is the 'mark of the mental'. It distinguishes the mental from the physical, and as such forms something like the last line of defence against the attempts by materialist reductionism to incorporate mind in the realm of the physical.

The problem—how things in the world are both distinct from, and related to, things we have in mind—can be seen to surface in Fodor's (1980) methodological solipsism. For Fodor, the formality condition demands that the Language of Thought contains only formal features, and forbids semantic relations between representations and the environment within cognitive science. As can be seen in Brentano and ever since, mentalism attempts to set mind apart both from the physical world, and from the biological

organism in which it is embodied. This double dualism, of mind and body, and of mind and world, strongly contrasts with the naturalist or biological perspective that considers mind as a function of the nervous system, and as the connection of organism and environment.

### *Solipsism, Formalism and Individualism*

*Fodor (1980) on solipsism and the formality condition.* Originally, Fodor (1980) built his case for rational psychology (methodological solipsism) on the *formality condition*, which is roughly circumscribed as the exclusion of all semantic notions like truth, reference, meaning, aboutness, and so on. In addition, he argues that the only viable way of talking about what a subject has in mind and what causes his or her behaviour is an opaque construal of mental content; extensional relations to the world do not explain behaviour. Furthermore, Fodor (1980) takes Putnam's (1975) notion of *narrow content* (i.e. not presupposing the existence of anything beyond the subject that has the mental content) as being consistent with opacity. Rational psychology has the advantage of consistency with logical semantics. Naturalistic psychology, on the other hand, is impossible in Fodor's view; its presumed explanatory power would depend partly on the way the world is, and it would therefore require perfect knowledge of all the laws of nature. Hence, nothing can be said about it until physics is complete. The latter point I will call the *Bloomfield argument*. (Bloomfield argued that semantics is beyond the linguist's [and the psychologist's] reach, since it depends on knowledge about the world.)

Of course, Fodor does not deny that mental operations have semantic properties. The claim entailed by the formality condition is just that no respectable psychological science can be made of semantics (it is as elusive as *Dasein*), and that the mind has no access to the semantic properties of its representations.

In subsequent publications Fodor (1987, 1991a) has reshuffled his arguments for rational psychology, relying more on the causal-nomological requirements for psychological theories than on the formality condition. He now connects the notion of narrow content with the requirement of a causal-nomological construal of psychological explanation (Fodor, 1991a), rather than with the formality condition or with the Bloomfield argument—as will be elaborated below, this yields the thesis of individualism. In response to Burge (1986), he now distinguishes solipsism (which is grounded in the formality condition) from individualism (Fodor, 1987).

Thus, three more or less independent arguments are sometimes collectively, sometimes separately, discussed in the literature, under a somewhat confusing variety of labels, such as internalism, individualism or solipsism (e.g. Burge, 1986; Egan, 1992; McClamrock, 1991; Van Gulick, 1989), or wide vs narrow functionalism (Harman, 1988; Kitcher, 1985).

In what follows, this set of arguments and some later refinements will be discussed. In particular, it will be argued that the assumption that a naturalistic psychology (like Gibson's) would have to specify the laws that connect organism and environment (the Bloomfield argument), and that there are no such laws about real-world objects (cf. Fodor & Pylyshyn, 1981), rests upon a very restrictive, strictly causal–nomological conception of scientific explanation.

*Describing inputs: the Bloomfield argument.* The Bloomfield argument holds that one cannot investigate relations between organism and world unless everything about the world is known, or, more precisely, Fodor argues that no science can be made from organism–environment interactions because no nomological, counterfactual-supporting laws of organism–environment interactions are available (at least not until physics has been completed) (Fodor & Pylyshyn, 1981). Sober (1982) objected that thus all relational and functional explanation, such as in the physiology of digestion, would be excluded from science—which is obviously absurd. Fodor's (1982) answer is that these explanations are 'natural history', not genuine (nomological) explanations.

What I have called the Bloomfield argument is related to the issue of the level of description of inputs and outputs. Block (1980, pp. 293–296) showed that the old problem, namely, what constitutes a stimulus or a response, still haunts Turing machine functionalism. He argues that a physical description of inputs and outputs yields a version of functionalism that is problematic. Inputs and outputs, like mental states, can be realized in many physical ways, so that there is no unique physical characterization of inputs. Fodor's argument depends on the assumption that only a physical description of inputs is feasible. It can be argued that if a non-physical, functional description of the inputs were possible in scientific explanatory practice, this would undermine the Bloomfield argument.

The problem of the level of description of inputs is related to the distinction between distal and proximal stimuli (Looren de Jong, 1995). Fodor (Fodor & Pylyshyn, 1981) believes that only proximal stimuli (processes at the sensory surfaces) can be part of psychological explanations, and that the relation between the proximal stimulus and perception is a strictly causal one, whereas a tradition leading from Heider and Brunswik to Gibson and Marr includes general characteristics of the environment in theories of perception. Below it will be argued, first, that distal stimuli (real-world objects) do figure in actual theories in perception, and, second, that functional explanation is as legitimate as causal explanation.

*Solipsism, formality and taxonomy.* The formality condition as a constraint on taxonomy for psychology looks like a rather curious piece of a priori legislation imposed on cognitive science. The central tenet of Fodor's CTM



is that a formalized syntactical language which excludes reference is the medium of thought. This forces him to recognize that he cannot have both the world and computation; so he decides that the world must be renounced, and psychological taxonomy must ignore the references of mental states (Kitcher, 1985).

Kitcher (1985) criticized Fodor's use of the formality condition, which in her view is much too strict and would prohibit interesting and legitimate types of explanation. She argues that solipsism may be the base of one of a number of possible, probably expedient taxonomies, but by no means the only one. Fodor's 'requirement of strict monogamy on taxonomy' is misguided: other taxonomies remain possible in cognitive science. Kitcher (1988) illustrated this by Marr's theory of vision, which postulates a level of analysis for the environmental problem to be solved, and another level where the ('syntactical') algorithms which execute the task are specified. Solipsism, then, is just a strategy that is legitimate in cognitive science, but it is not a foundation for repressing other (e.g. relational or naturalist) strategies.

Fodor admits as much in his 1987 book. Solipsism is the consequence of an *empirical* claim about the nature of mental processes, which may prove to be wrong. Individualism, on the other hand, is a *metaphysical* principle about the relation of mental and physical processes and the nature of scientific explanation.

*Individualism, supervenience and narrow content.* In later publications, Fodor (1987, 1991a) seems to shift his defence of rational psychology from the formality condition to metaphysical arguments using the notions of supervenience and causal powers. Fodor (1987, 1991a) invokes the principle of (strong) supervenience which holds that mental processes cannot differ when the associated (subvenient) physical states are identical (cf. Kim, 1993).

Putnam's (1975) classical Twin Earth argument was designed to prove that the meaning or content of mental states depends not only on the physical make-up of the owner of these states, but also on the environment in which he or she lives. Briefly, Putnam asks us to imagine that there exists a Twin Earth which is identical with this earth with the exception that water over there is XYZ rather than H<sub>2</sub>O. On Twin Earth there is someone who is identical with me molecule for molecule; whenever he and I entertain the thought 'water', our physiological states must be identical. However, the meaning or content of our respective mental states 'water' must be different, since his refers to XYZ and mine to H<sub>2</sub>O. Hence, the world codetermines the meaning of mental representations. However, if we assume that mental content supervenes on physiological conditions, then we face a dilemma. There can be no psychological difference between physically identical states (otherwise, there would be disembodied thought). Therefore, the internal



representations of the twins must be identical for purposes of psychological explanation, but they may have different meanings (when placed in different environments).

The solution Fodor suggests for this dilemma is to distinguish between narrow and wide content, the latter being partly dependent on the environment. The representations in the Twin Earth case are 'narrowly' identical, but different when 'widely' individuated. Supervenience, then, entails that, unless such ontological horrors as immaterial causes or action at a distance are assumed, mental content must be individuated in a 'narrow' or internalist way, ignoring the environment insofar as it does not causally (peripherally) influence the subvenient physiology.

Thus, the important difference between solipsism and individualism is that 'solipsism (construed as prohibiting the relational taxonomy of mental states) . . . is in fact an empirical theory about the mind: it's the theory that mental processes are computational, hence syntactic' (Fodor, 1987, p. 43). On the other hand, 'individualism does not prohibit relational individuation of mental states, it just says that no property, relational or otherwise, counts taxonomically unless it affects causal powers' (Fodor, 1987, p. 42).

Since in Fodor's view scientific theories individuate mental states by their causal powers, and contextual (wide) factors cannot be causal, individualism is the only genuine scientific option. He does not want to banish relational concepts, but he thinks that for mental purposes to be real and scientifically respectable, they must be causally effective. Arguments for individualism are thus tied up with the notion that only causal–nomological explanations are worth having, and only causally effective mental states are scientifically interesting. Fodor's ideas on individualism and internalism have not gone unchallenged.

### *Objections*

*Supervenience and internalism.* It is a moot point whether supervenience necessitates a taxonomy that ignores the environment. Burge argues that individualism (the thesis that 'there is no necessary or deep individuating relation between the individual's being in states of those kinds and the nature of the individual's physical and social environment'—Burge, 1986, p. 4) does not follow from supervenience:

. . . mental states and events may in principle vary with variations in the environment even as an individual's physical (functional and phenomenological) history specified non-intentionally and individualistically remains constant. (Burge, 1986, p. 6)

He argues that even if it is granted that changes in mental states are caused via local causes from the environment on the body, these may still be individuated partly by reference to distal stimuli. More generally, according to Burge, causal relations among intentional states do not necessarily

supervene on the underlying physiological transactions; the latter may only *mediate* intentional transformations. The mental states which cause behaviour are not fixed by brain states alone. Local causation does not require local type-individuation. Furthermore, Burge (1986) contends that philosophical arguments for internalism should not run counter to explanatory practices in cognitive science. In this vein, Burge (1986) analyses Marr's theory of perception as a *de facto* refutation of individualism: Marr assumes an irreducible level of description involving assumptions about the structure of the world, about what it is that is perceived (cf. Banks & Kraljick, 1991, pp. 306–307).

In another refinement of his previous arguments, Fodor (1991a) starts with a sort of gambit. Individualism is in fact only relevant for the metaphysical questions of causal powers, identity and natural kinds in psychological explanation, not for semantics of mental content and a lot of other issues in philosophy of mind. He now agrees that the mental contents of Putnam's twins are different as a result of their different mind–world relations, but he maintains that this difference is uninteresting with respect to their causal powers, that is, the sort of behaviour they produce. In Fodor's view, my water thoughts' connection with H<sub>2</sub>O, and my twin's with XYZ, are conceptually, not contingently, necessary, and therefore the difference between them is (nomologically) as uninteresting as any conceptual truth. Hence, since no taxonomically relevant differences follow from differences in wide content, narrow content should remain the yardstick for psychological taxonomies.

Thus, Fodor admits that environmental considerations enter into explanatory strategies but he maintains that they do so in a scientifically trivial way. The question now becomes, are we really to believe that mind–world relations are conceptual, uninteresting and uninformative? Again, like the Sober/Fodor (1982) discussion, the reasoning hinges on Fodor's adherence to a strictly nomological model of explanation. The joint notions of narrow content and functional causal role imply that psychology should restrict itself to the internal economy of the mind as explanation of behaviour. Therefore, it seems that a feasible alternative model of explanation could undermine the support for individualism.

*Good questions and causal answers.* To start with, it can be argued that not all good questions have causal answers. Van Gulick (1989, p. 152) argues against the internalist doctrine that cognitive psychology should type-individuate psychological states in a way that does not reflect any external or environmental facts about the biological or cultural environment of the organism under study. He notes that one can be in search of interesting generalizations rather than causal explanation: 'perhaps in some cases generalizations emerge only when their operations are described in a semantically interesting way' (Van Gulick, 1989, p. 158). Furthermore, he

makes the important remark that local causation does not imply local type-individuation; structurally identical subsystems may be put in different categories when serving in different contexts. For example, physically identical electronic components may serve different functions in different parts of a system, and therefore be individuated differently. The same line of reasoning might apply to physical states on which different mental states supervene.

Owens (1993) argues against Van Gulick that in these cases where the same component serves different functions in different contexts, there are differences only in terminology, not in reference; causes are independent of descriptions, hence, he argues, the components must be identical with respect to their explanatory powers. This line of reasoning simply repeats the argument that only causes are explanations, and causes are to be conceived as elements of a (realist) ontology.

The problem of individualism, then, is *not* about how context might causally affect mental states, but about the import of contextual factors in type-individuating mental states (cf. Egan, 1990). It seems entirely plausible that type-individuation can be contextually determined, and that interesting functional generalizations about organism–environment relations can be made that are not restricted to local causal effects (Van Gulick, 1989). For example, the interpretation by a psychophysicologist of increased energy consumption in the frontal lobe may depend on the function its associated mental state serves in the context of the organism's environment.

*Internalism vs individualism.* A line of defence taken by Egan (1992) tries to salvage individualism by distinguishing it from internalism. She contends that a computational theory (like Marr's) is individualist in the sense that it individuates mental states without reference to the environment. However, she then argues that computational theories can be semantically interpreted using an additional interpretation function that ascribes the contents to, and explains environmental adequacy of, computational mechanisms. The latter adverts to wide semantic content and does not supervene on local physical or computational states: a computational mechanism is identical in different environments. Thus, although Egan admits that environmental considerations are indispensable, she maintains that these considerations do not figure essentially in the computational *theory*, only in the interpretative *model*. Semantic interpretation is no part of the individuating apparatus of the theory.

Egan's solution thus gives the telefunctionalist all he or she wants, since the notion of a legitimate and explanatorily useful model seems for practical purposes to tally nicely with a functional individuation as an answer to a good question. (Incidentally, although Egan seems to consider her argument a defence of individualism against Burge, the fact that in her view the intentional and representational content of thought is not essential for

computational models undermines the claim that the syntactic machine mimics the semantic machine. Furthermore, the rescue apparently depends again on the formality condition. It presupposes rather than defends the adequacy of computational theories for psychology.)

*Local and distal causes.* An interesting consequence of functional individuation is that it opens the possibility of identifying distal stimuli, irrespective of differences in proximal causes. Assuming that nothing affects mental events unless arrived at via the body's surface does not commit us to construe perception as local effects on the senses (cf. Burge, 1986, pp. 15–16). Non-locally supervenient (i.e. wide functional) individuation of inputs can be a perfectly legitimate type of explanation.

Below, Heider's (1927/1959) and Brunswik's (1952) notion of (distal) stimuli and Gibson's (1979) ecological objects taking precedence over (proximal) local sensations in the study of perception will be discussed as highly relevant examples of such distal non-local causes. This suggests an extension of the principle that the input of perception can be described at different levels (Block, 1980). Fodor (1980; Fodor & Pylyshyn, 1981) assumes that inputs can be described only at the physical level. Gibson explicitly rejects this and has attempted to develop a description of the ecological environment in terms of action possibilities for an organism (Gibson, 1979; Wilcox & Edwards, 1982). There may well be interesting generalizations about perception that are described at a functional level of analysis which is concerned with the distal, functional or ecological aspect of stimuli rather than their local impact on the senses (Gibson, 1966).

*Conclusion: Fodor's arguments for rational psychology.* Solipsism is a consequence of the empirical claim that mental processes consist in symbol manipulation; it does not support the conclusion that individualism is the only possible strategy. Solipsism may be mandatory in some of the many mansions of psychology, but not in all.

*The Bloomfield argument* about organism–environment relations rests on the claim that only the physical level of description is adequate for the environment, and that there can be no laws for mind–world connections (Fodor & Pylyshyn, 1981). As will be argued below, it is effectively refuted by Gibson's ecological description of the environment.

*Individualism* as a methodological prescription of how to taxonomize mental processes depends on a view of what constitutes a legitimate explanation (in Fodor's view, laws). Thus individualism, unlike solipsism, does not depend on the assumption that computation (or even representation) is the quintessence of the mind. Like the Bloomfield argument, it is independent of claims about the internal format of the mind; it simply prohibits every taxonomy adverting to wide content as a violation of the canon of nomological explanation and supervenience. Hence, the meta-

physical arguments for individualism do not hold. We should at least admit the possibility that global and context-dependent type-individuation might be fruitful and such arguments should not be used to prohibit asking interesting empirical questions.

Fodor's adherence to an exclusively causal–nomological style of explanation was identified as an underlying motive of his internalism. Fodor assumes that for the mental to be real, it must be causally effective, and causal effects must supervene on, and hence be confined to, the physical constitution within the skin. Against Fodor it can be argued that there might be interesting generalizations that do not 'end at the skin' and that go beyond local causes. Below, such an alternative type of explanation will be explored.

Criticism of internalism and causal explanation does of course not automatically legitimize the proposed alternative, the relational concept of mind and functional explanation. This will have to be motivated, ultimately by empirical success. I will attempt to defend this approach, first, by ironing out a number of theoretical and conceptual problems with functional explanation, and, second, by presenting Gibson's ecological psychology as an instance of functional relational explanation that has proved to be empirically successful.

## **Towards an Alternative: Wide Functional Explanation**

### *Introduction*

It has been argued that Fodor's nomological bias forces him in the direction of narrow content and local supervenience. Although there is of course nothing wrong with causal explanation in psychology or elsewhere, what is argued here is that relational, wide, functional and contextual explanations taking into account mind–world relations may also address genuinely interesting aspects of reality. The thrust of the second half of this paper is that Fodor's position precludes the asking of a number of good questions. Illuminating generalizations are possible about functional and distal factors that do not honour local supervenience. The alternative suggested here is functional explanation. The concept of function has genuine explanatory value which cannot be reduced to causal explanations; it also includes the environment.

First I will outline the legitimacy of the concept of function (teleofunctionalism, as distinct from Turing machine functionalism) and functional analysis as a contrast to nomological taxonomies. It will be concluded that the environment is implied in teleofunctional analysis. Taking together the two last points, it is argued below that an interesting alternative to causal–nomological explanation entails a wide functional view of psychological explanation. Next, the method of functional analysis will be discussed as a

legitimate level of explanation that can coexist with causal explanation, and is empirically fruitful. Finally, it will be shown that in Gibson's work both the use of the functional description of perceptual systems, and the possibility of a distal description of the environment can be found, thus *de facto* refuting the Bloomfield argument and the monopoly of causal explanation.

### *The Concept of Function*

*Function and law.* Function ascription is a crucial, but somewhat problematic, element of biological explanation. Its defenders face criticism of triviality, vacuousness and crypto-vitalism. Roughly, functional explanation of some trait or organ (e.g. the function of the heart is to pump blood) holds that such a trait exists 'in order to'; functional explanation is teleological (Wright, 1973). The concern about functional and teleological explanation in the philosophy of science in the late 1950s was whether it wasn't a form of crypto-vitalism, appealing to immaterial causes or backward causation. More precisely, the question was whether functional explanations could be fitted into the received view, the Deductive–Nomological (D–N) model. The D–N model of explanation says that explaining a phenomenon consists in deducing a statement describing that phenomenon from a general law plus initial conditions. For example, water boils at 100°C, this water is 100°C, so it boils. Therefore explanation involves general laws, is a matter of deductively generating propositions in a strictly logical way, and is equivalent with prediction.

The D–N model conceives of reduction as a relation between theories in the sense that a more complex theory can logically be derived from a more basic one. Logical positivists envisage reduction as a logical deduction of higher level laws from lower level laws plus boundary conditions specifying the conditions under which the latter operate. In this way, it was attempted to replace goal-directed explanation by an equivalent causal–nomological explanation. Such attempts have not been successful (see Salmon, 1990, pp. 26ff., 111ff.). Neither have attempts to reduce teleological and functional behaviour to pre-existing representations (e.g. Boden, 1972), since this shifts the problem from function to the equally problematic notion of representation (Bigelow & Pargetter, 1987). Also the mentalist assumption that some kind of intention, design or representation underlies functional or teleological behaviour ignores that natural teleology includes organisms too simple to have mental states (Bedau, 1990).

At present the consensus seems to be that functional explanation is *sui generis* and has a legitimate place alongside causal explanation (Cummins, 1983; Mayr, 1992; Rosenberg, 1985). This brings us to the question: what is involved in attributing function?



*Function.* Wright (1973, 1976; see also Boorse, 1984) proposed a so-called aetiological account of function, based on causal history: the function is the reason (cause) why a trait is there. Put in a formula, Wright (1973) maintains that:

... the organ is there because it performs the function, and the function is a consequence of the organ. (p. 161)

This seemingly trivial formula has important consequences. First, it entails causal history. An organism has a heart *because* (causal commitment) it pumps blood. Second, it supports a function–accident distinction. Real functions explain the presence of an organ, while accidental activities, like the heart’s producing heart sounds, do not. In consequence, function ascriptions are genuinely explanatory; they tell us *why* an organ or trait exists. The consequences of an organ’s function account for its being there, explain its presence.

Boorse (1984) lists some objections and proposals for improving Wright’s model. The major problem is its tendency toward trivialization. Organic traits can apparently be ‘explained by the things they do, by which they may be explained’ (Boorse, 1984, p. 370). This can be remedied by considering a function as a contribution to a goal. This definition has the important consequence that it makes the function of a thing dependent on context. Therefore, a function is not a fixed property: ‘What converts a function X performs into “the function of X” is our background interest in the context in which the function statement is made’ (Boorse, 1984, p. 380). Function ascription is relative to the system, the goals and the time scale under study. Different disciplines address different levels of goals from different angles, singling out different functions. In biology, teleology is seen at different levels of organization. There is no single unique goal of behaviour but different patterns can serve one or more goals. So, according to the Wright–Boorse view, function is a teleological notion (contribution to a goal), and it is a methodological notion, depending on explanatory interest and context, rather than an ontological commitment.

*Reduction.* The status of functional explanation has attracted the attention of philosophers of biology, especially in the context of the reduction vs the autonomy of biology vis-à-vis physics. Rosenberg (1985) argues that the difference between nomological and functional explanation is a matter of degree, rather than a qualitative difference. It is a difference in local tactics rather than in global strategy. For example, the explanation of the fact that DNA has a methyl group while RNA hasn’t rests on functional considerations (DNA must be more resistant to damage) which cannot be given in purely biochemical terms (i.e. causal laws operating on DNA and RNA structures). Viewed from the chemical level, the difference is accidental. Thus, function is an indispensable explanatory concept. Functions and laws



have a many-to-many relationship which precludes a serious attempt at replacement of the former by the latter; they reveal patterns which cannot be seen from a causal–nomological point of view.

As the examples mentioned above illustrate, thinking about functional explanation has a distinctly biological flavour. The reason for this is that in the philosophy of biology the attribution of function has received ample attention, presumably because in biology the choice between causal–physical and teleological explanations is most critical. We will see a clear psychological example of functional explanation below in the discussion of Gibson's work.

*Functional explanation and survival.* Functional laws predict that in a system with a certain goal a form of behaviour will occur because it brings about the goal. The 'because' in such statements might be explicated in terms of natural selection, which would shift the problem from the notion of function to the notion of adaptation. However, function ascription can be detached from evolutionary considerations. As Boorse (1984) suggests, Wright's focus on causal history is just one among a number of possible perspectives on goals, and is not a necessary part of the meaning of the concept of function. The functions a physiologist ascribes to an organism under study would not change if some evolutionary missing link were found where the same organ had a different role. Influenced by classical epistemological analysis, Wright primarily answers the philosophical question ('Why is a trait there?'), rather than the scientific question ('How does the system containing that trait work as a whole?'). The latter question refers to the contribution a part makes to the whole system, independent of evolutionary concerns (Boorse, 1984). So, the concept of function should be detached from evolution, in the sense that survival value is not required to underwrite functional analysis.

Hence, functional explanation is not dependent on evolution and survival, and the identification of system properties is independent of, and precedes, evolutionary explanation. Therefore function ascription is not limited to strictly biological explanations (Sober, 1985). For our purposes, this implies that functional explanation can be used in situations (e.g. in psychology) where the connection with adaptation is not obvious. Below it will be argued that Cummins's (1983) functional analysis provides a methodological tool for such an operational explanation.

*Function and environment.* A correction of Wright's theory, important for our subject of mind–world relations in psychology, was proposed by Bigelow and Pargetter (1987). They wanted to counter the theory's 'backward-looking' tendency, which makes function too much dependent upon more or less contingent, evolutionary events in the past. They therefore proposed a 'propensity theory', emphasizing the forward-looking, disposi-

tional and environment-relative nature of functions. In their account, function ascription refers to a relevant effect on appropriate occasions, so that something can count as a function even before it has actually contributed to survival. Functions are furthermore relative to their surroundings, and are 'subjective' in the sense that they *would* constitute a survival-enhancing property in a specific environment. The important point is of course that in this view function ascription involves the surroundings in which an organism lives.

*Conclusion.* The upshot of these (mainly biological) considerations is that: (1) function may be considered a respectable explanatory concept in its own right; genuine functions can in principle be distinguished from accidental ones; (2) function is not conceptually dependent on, nor does it have to be reduced to, considerations of evolutionary fitness; (3) function is clearly tied to teleology, to serving a goal; (4) function refers intrinsically to certain environmental conditions; (5) functions are not fixed properties, but depend on explanatory purposes which cross-classify with causal laws and anatomical structures, and purport to answer different questions. Next, we will look at some ideas on functional explanation that may be applicable to psychology.<sup>1</sup>

### *Functional Explanation*

Most of the ideas on the notion of function discussed above arose in theoretical biology. Some proposals exist on how to use the concept of function as an explanation of a system's behaviour in psychology. The idea of functional analysis as proposed by Cummins and Wilkes, and Lycan's homuncular functionalism, seem to fit well into the framework of functional explanation outlined above. Cummins (1983) has proposed that mental processes can be explained by analysing them as functions, and he contrasts this type of explanation with the causal subsumption model which Fodor (1991b) thinks fits the bill. The question to be answered by functional analysis is about instantiation rather than causation. In virtue of what can a system have such and such properties or capacities? Functional explanation, according to Cummins, decomposes functional capacities (or dispositions) into a number of simpler functions; subfunctions, which together instantiate the analysed function. In principle functions can be instantiated in different structures, and no relation between form and function is assumed. Since multiple instantiations are possible of one property in different physical structures, instantiation is not compatible with the classical reductionist strategy.

A similar concept has been proposed by Wilkes (1978), under the label structural-functional analysis. She suggests that functions can be hierarchically decomposed. For a given function, a structure can be specified which

then can in turn be considered as a function, to be specified by further analysis in subfunctions. This results in a sort of Chinese boxes procedure: a progressive decomposition into simpler and more elementary functions until a basic level of mechanisms, brain structures or perhaps individual neurons is reached. Wilkes suggests this model as a solution for the mind-body problem. The functions of the nervous system can be analysed in terms of (sub)functions and subserving structures, and she thinks that this is the strategy for neuropsychology. The functional explanation of a mental capacity is its decomposition into systems described at the level of functional neuroscience, which may then in turn be decomposed in increasingly anatomically localized and mechanistically explainable structures.

In Wilkes's model such typical mental concepts as intentions and representations only figure at the very top of the functional hierarchy. The general picture is that mind is a hierarchy of functions situated between an intentional level at the top and a mechanistic causal level at the bottom. The level of mechanisms which can be explained causally, and where functional explanation becomes trivial, is the lower boundary of functional analysis.

In the same vein, Lycan (1987, chap. 4) proposed 'homuncular functionalism': the organism's abilities are broken down into subpersonal agencies, which are teleological characterizations at various levels of functional abstraction, and explain the organism's having those abilities. Like Wilkes, he argues against the dualist dichotomy of mind and body, hardware and software, prevailing in the computational theory of mind. Function, teleology and mentality are a matter of degree, and gradually disappear at lower levels. Like Sober, he considers function as corresponding to teleology ('function is honest-to-goodness natural teleology'), in contrast with the non-biological notion of functional role in Turing machine functionalism.

Thus, these authors consider mind as lying on a continuum from lower, biological to higher, more mental forms of adaptive functions. Ideally, then, these functional and gradual approaches might bridge the dualist gap between mind and body which is characteristic of mentalism (Wilkes, 1980). Function, according to these authors, is a distinct level of analysis (or a hierarchy of levels), situated above the level of physical mechanisms. However, the aspect of the environment remains somewhat neglected.

*Function, environment and teleology.* As mentioned, the biological conception of function implies an appeal to environmental constraints; this element is missing (or at least not prominent) in Cummins's (1983) non-teleological functional analysis (Bechtel, 1986). It can be argued that the role of the environment is crucial not only in biological, but also in psychological explanation.

Harman (1988) writes:

... psychological explanation is a kind of functional explanation in the way that some biological explanation is. ... Wide functional explanations

... typically appeal to an actual or possible environmental situation of the creature whose activity is being explained ... narrow functional explanation appeals only to internal states of the individual, and says nothing about how the creature functions in an actual or possible environment. (p. 11)

Wide functional analysis thus entails that in psychological explanation there is (usually implicit) reference to the environment, and that it involves teleological considerations about the relation between the organism and its environment. Against Fodor, Harman (1988) maintains that psychological explanations require the wide view:

... you do not understand how people operate psychologically unless you see how their mental states are related to perception of the environment and to action. (p. 11)

Harman (1988) thinks that

... narrow psychological function [is] an abstraction from the notion of wide psychological function ... autonomous narrow psychological functionalism would be incoherent because only a wide psychological functionalism can motivate appropriate distinctions between aspects of a system, irrelevant side effects and misfunctions. (p. 11)

Functional analysis should be amended to include more emphasis on the role of the environment. Bechtel (1985) called attention to the similarity between a relational construal of mind and the concept of function. The relation of a system to its environment is the crux of biological functions, hence ascribing function to (part of) a system implies its environment. His suggestion is to consider the environment as an additional level of analysis, over and above the level of causal role (Turing machine function). Teleological functional analysis should, according to Bechtel (1986), distinguish three levels: the components, the system and the environment, whereas Cummins considers only the first two levels. Applied to psychology, this notion of teleological functional analysis means that one should look beyond the mental apparatus as such ('narrowly construed') to the way it deals with its environment ('wide functionalism').

To sum up, functional analysis in the fashion of Cummins and others holds that the way a system is organized explains some of its activities; these systemic properties are emergent with respect to the components. Furthermore, following Bechtel and others, the environment can be seen as an additional constraint on these system properties, involving a higher level of analysis. Reference to the environment is part of the explanation of what these properties are really doing, why they are adaptive or not.

Returning to our earlier criticism of Fodor, we can now see the full force of Sober's (1985) demand to put back function into functionalism. The teleofunctionalistic approach, which includes the environment and individuates mental states with respect to what they do in the world in which the

organism lives, makes all the difference. Fodor's Turing machine functionalism, with its solipsistic view of functional states, takes only the internal economy of the system into account. As we argued above, following Bechtel, the internal systemic level of analysis is only a restricted and partial view of the mental, and should be supplemented with an additional level of environmental considerations.

It seems that the pattern of functional explanation, concentrating on organism–environment relations, can be found in biology and to some extent in biologically oriented psychology, such as the ecological approach, to which we now turn. I hope to show that functional explanation really works, since legitimization of a method in psychology must ultimately come from its empirical success, from good questions and the interesting generalizations it stimulates.

### **Ecological Psychology and Functional Explanation**

Gibson (1966, 1979) was a sharp critic of representational theories of perception. In his view, organisms do not need internal representations and computations to perceive the world, they can directly pick up the information in the optic array and tune in to the world (in his idiom information is not something to be processed in the mind, but is a property of the ambient light, specifying the environment). Thus direct perception is a biological process of adaptation to the environment, of resonating to objective properties of the world, rather than having mental representations. In Gibson's system, organism and environment are reciprocal and interdefined: Gibson's concept of affordances holds that the world is perceived in terms of what action possibilities it affords to a given species, what can be done with it (Cutting, 1982; see also Reed, 1988).

Gibson's book *The Senses Considered as Perceptual Systems* (1966), obviously influenced by American functionalism (E.J. Gibson, 1982; cf. Lombardo, 1987), provides a functional psychology of sense perception. He considers perceptual systems as exploratory and adaptive functions that are not identical with the senses, and cannot be reduced to neuroanatomically defined structures or explained by sensory physiology. Gibson's perceptual systems cross-classify local effects on anatomically defined sensory organs (e.g. the orientation system comprehends the muscles of the neck). Rather than being based on intra-organismic events like sensations and specific nerve energy, perception is a function of the environment.

Gibson's (1966) book, then, is an example of functional psychology; perceptual systems are identified according to their function. Gibson (1966, pp. 5, 54–56, 264) invokes the notion of 'vicarious functioning' (coined by Lashley), implying that the same function can be accomplished by different anatomical structures. Furthermore, perception is not built out of sensations,

peripheral stimulation of sensory surfaces, but consists in the pick-up of distal information through active exploration. The same local anatomical effect can be involved in different functions, and the same function can be accomplished through different local effects.

In his *The Ecological Approach to Visual Perception* (1979) Gibson attempts to redefine the environment at a functional level of descriptions, that is, relative to the organism. The ecological perspective requires a definition of the environment not in terms of physical entities, impinging on transducers (cf. Fodor & Pylyshyn, 1981), but in organism-relative terms, that is, in terms of meanings or action possibilities for a given species. Gibson's description of the ecological environment involves entities like media and surfaces, rather than the categories of classical physics (sound and light waves). Wilcox and Edwards (1982) argue that the ecological description of the environment is as equally legitimate as the classical Newtonian one. Thus, Gibson's psychology at least sketches an answer to the problem of defining inputs and outputs (Block, 1980; Sober, 1985) in a functional way.

That perception, according to Gibson, is picking up real-world information (specifying affordances) rather than processing sensations implies that local causal processes at the periphery are not what counts in the explanation of perception. Like Heider (1927/1959) and Brunswik (1952), Gibson insists that the distal stimulus, the ecological object or event, rather than the proximal stimulus, the local sensory processes, is the appropriate level of description for the input of perception.

The Heider–Gibson argument against the monopoly of the proximal stimulus is that the order in the medium can only be understood if it is related to the corresponding source in the external world. Perceptual systems require a functional description in terms of what they do with respect to the organism's interactions with its environment. To borrow a simple example from Churchland, an infra-red heat sensor and a movement detector constitute the rattle-snake's mouse detector only when seen from a wide environmental perspective. It is not intrinsic in the causal workings of the internal mechanisms themselves.

Thus, Gibson's ecological approach exemplifies Burge's (1986) and Van Gulick's (1989) arguments for the possibility of non-local (in the present author's reading, functional or relational) description of organism–environment interactions. The ecological level of description seems a perfectly legitimate way of describing inputs and outputs at a global or functional level, once it is admitted (as we argued above) that more (levels of) functional perspectives can be legitimate explanations, and explanation should not be restricted to physical and local causality. As such, it constitutes a feasible alternative to Fodor's (1987) argument that mental states supervene on brain states, and that if the brain states of two organisms are identical, then their mental states must also be identical, and that therefore



only the local impact on the sensory surface enters into theories of perception. Contrary to Fodor, Gibson's system is a shining example of the feasibility of wide, non-local generalizations in perception, and I submit that as such it shows the empirical success of functional explanation.

Cutting (1993), in evaluating Gibson's contribution to psychology, concludes that the ecological approach has been influential in emphasizing the biological and evolutionary role of perception. Gibson's emphasis on the tight coupling of the structure and function of the visual system to the task and the environment influenced Marr's ideas on the task or computational level of analysis (see Looren de Jong, 1995). Gibson also initiated new paradigms in perceptual psychology. The best-known example is depth perception, where Gibson more or less started his career. Depth perception shows that the traditional analysis confined to internal processing is insufficient and the environment has to be taken into consideration. Without being exhaustive, other interesting experiments in the ecological tradition are those which involve interweaving of perception and action. In this line of work, Neisser's (1976) influential model of the perceptual cycle was inspired by Gibson. Also, research on optical flow and on manual exploration could be mentioned as examples of empirical applications of Gibson's insistence on the coupling of perception and action.

### **Conclusion: A Relational Concept of Mind**

It has been argued that Fodor's arguments for internalism are based on debatable philosophical assumptions about ontology and the nature of explanation, and that other options are available with regards to explanation. Furthermore, the question whether relational or functional individuation in psychology can be genuinely explanatory can be answered in the affirmative when we look at explanatory practices as seen in current psychological research. As an example of these, Gibson's system was mentioned, which produces interesting generalizations in specific domains of psychology. It is rather implausible that these generalization about mind-world relations can be interpreted away as 'conceptual', as Fodor suggested. Gibson, first, proposed a system of functional individuation of perceptual systems, independent of local processes at the senses, and, second, he sketched a taxonomy for organism-relative description of perceptual inputs, which constitutes a legitimate alternative to Newtonian physics. The first is an example of real teleofunctionalism, individuating mental processes by their role in the environment, rather than by their internal causal economy, the second *de facto* refutes the argument that input must be described at a peripheral or proximate level.



### *Levels*

Several authors suggested that much of cognitive science can be captured in a three-level model (Dennett, 1987; Marr, 1982; Pylyshyn, 1989; see Sterelny, 1991, pp. 44–49 for an overview and comparison). As mentioned, the difference between Turing machine functionalism and teleofunctionalism is that the latter includes environmental considerations. It is suggested that teleofunctional analysis may be considered a higher level of analysis than Turing machine functionalism (Sterelny, 1991). In this way, Bechtel (1985) argues, information-processing psychology should provide the explanation at the level of internal mechanisms for the phenomena described by ecological psychology.

It can be argued that Marr's (1982) notion of levels of analysis implements this suggestion. While admitting that Gibson was right in assuming that information is in the light rather than being a subjective construction, Marr (1982, pp. 29–31) added that some organismic process is needed to extract it, and the study of the information in the light (at the environment or ecological level) has to be supplemented by the level of algorithms that do so (Looren de Jong, 1995).

Cummins's and Wilkes's functional analysis seems to tally with such a hierarchical view of decomposing functions into more basic subfunctions, starting with the functioning of the organism in its environment at the top, and bottoming out at causal mechanisms.

Higher levels are more context-dependent since they involve a larger, more complex system. Also, what counts as a system and what functions are ascribed is dependent on explanatory interests, and is not fixed in the way internal causal mechanisms are (cf. McClamrock, 1991; Van Rappard, 1995). Thus, environmental considerations make visible patterns of behaviour that are accidental from a narrow causal or internalist viewpoint.

### *Real Patterns*

Another way to consider the explanatory use of functional explanations is as really existing, but not causally effective emergent higher order regularities. Consider Dennett's (1991) example: the Game of Life, which is governed by perfectly deterministic laws controlling life and death of single cells, shows emergent patterns of higher level expansion and contraction discernible over several generations of cell families over the life space. These patterns are quite real in a pragmatic and observer-relative way.

Dennett suggests that analogously there is a level of description intermediate between the laws of physics and the level of conscious rule-following systems, namely the level of designs, formed under selection pressure, which are not explicitly and consciously following rules, yet are regular ('lawful') in a non-trivial way. In this way, teleofunctional descriptions like Gibson's can be 'real' explanations without being causal–

nomological. Teleofunctional explanations tell us where to look, how to ask good questions, how to select instructive patterns in the plethora of causal effects.

### *Conclusion*

To sum up then, a naturalistic concept of mind involving the way an organism interacts with its environment is, contrary to Fodor's objections, a really explanatory and legitimate part of psychology. The notion of function is crucial here since it sanctions a level of description independent of physical mechanisms. Furthermore, it supports distal individuation, taking precedence over local causal effects. Finally, it may carve out a 'real pattern' from a multitude of causes.

Gibson's ecological psychology illustrates two major features of naturalistic functional analysis: (1) perceptual systems are individuated by function rather than by the physiological laws of sensory surfaces; (2) the description of the input for perception includes the environment, that is, the real world, the distal stimulus, not the proximal effects on the senses.

Hence, a relational concept of mind that goes beyond narrow causal explanations and includes the environment is a feasible enterprise. We have started out with a rejection of the claim that mental processes should be studied in isolation, and argued that psychology can be made from mind-world relations. The latter were construed (in the Gibsonian way) mainly as functional and biological. However, what the ecological approach has to say on affordances and teleology clearly borders on issues such as meaning and intentionality (Looren de Jong, 1991). It might well be that this approach could be supplemented by a hermeneutic or narrative construal of mind-world relations, in terms of the cultural network in which minds are suspended (see Harré & Gillett, 1994). Mind should be taken in the midst of all its concrete relations!

### **Note**

1. It might be asked how naturalism and biologically oriented wide functionalism account for typically mental notions like mental content, meaning and intentionality that loom so large in Fodor's work. One naturalist approach is to circumvent traditional notions and aim for a reconstruction of the mental idiom (Churchland, 1989). As another, Millikan's (1986, 1989, 1990) biosemantics can be mentioned. Millikan proposes to consider the semantics of mental processes from the biological point of view. Beliefs have a proper function, in accordance with a design selected by evolutionary history, serving survival of the system of which they are part. A naturalist theory of intentionality and mentality considers mental processes as proper functions; representations are to be understood from their semantic function in the system, not as (syntactic) entities with meaning in themselves (narrowly construed) ('what makes a thing into an inner representa-

tion is . . . its function to represent'—Millikan, 1989, p. 283). Human thoughts can be thought of as 'natural signs' like a bee dance, signalling flowers.

A so-called 'normal' explanation tells us how a system has, in the course of evolution, managed to perform a function. Explaining a proper function requires that one knows the surrounding conditions upon which normal function, as distinct from malfunctioning, depends (Millikan, 1986, p. 58; 1990, p. 351); this of course argues against narrow functionalism. Analysis in terms of proper functions is, according to Millikan, not a deductive–nomological type of explanation aiming at prediction, but is more retrospective like historical explanations. Biological goals are basic, and human rule-following and mental representation can, according to Millikan, be considered derivatives from basic organism–environment interactions. Thus, Millikan's work is interesting for our purposes in that she attempts to extend biological functional explanation to representation, mind and meaning.

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